

A new combination in *Boronella* (*Rutaceae*) and a view on relationships of the genus

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Summary : A new combination in the New Caledonian genus *Boronella* Baill. is made for *Boronia koniambiensis* Däniker. *Boronella* apparently belongs to a lineage otherwise comprised of *Myrtopsis* Engl., *Euodia* J. R. & G. Forster, *Brombya* F. Mueller, and *Medicosma* J. D. Hooker. *Boronia* Smith and 16 related genera (the tribe *Boronieae* Bartling, as here construed) differ from the *Boronella* lineage in embryo shape.

Résumé : Une nouvelle combinaison dans le genre néo-calédonien *Boronella* Baill. est effectuée pour *Boronia koniambiensis* Däniker. *Boronella* apparemment appartient à une lignée comprenant aussi *Myrtopsis* Engl., *Euodia* J. R. & G. Forster, *Brombya* F. Mueller et *Medicosma* J. D. Hooker. *Boronia* Smith et 16 genres alliés (la tribu des *Boronieae* Bartling, analysée ci-après) diffèrent de la lignée *Boronella* par la forme de l'embryon.

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Two species of *Boronia* Smith have been described from New Caledonia, namely, *B. pronyensis* Guillaumin and *B. koniambiensis* Däniker. The former is considered to be conspecific with *Medicosma leratii* (Guillaumin) T. Hartley (HARTLEY, 1985 : 46) ; the latter is herein transferred to *Boronella* Baill.

Boronella differs from *Boronia* mainly in having branchlets with articulated (vs. continuous) cortex and embryos with elliptic or suborbicular (vs. linear) cotyledons. The embryo character also serves to distinguish the apparent relatives of *Boronella* (all of which have similarly broad cotyledons) from those of *Boronia* (all of which have linear cotyledons). As is shown below, there is evidence that these contrasting cotyledon shapes are conservative in the *Rutaceae*, which attribute supports their taxonomic validity. In a recent cladistic study WESTON et al. (1984) recommended the reduction of *Boronella* to *Boronia*, but they did not take embryo features into account.

***Boronella koniambiensis* (Däniker) T. Hartley, comb. nov.**

— *Boronia koniambiensis* DÄNIKER, Vierteljahrsschr. Naturf. Ges. Zürich 77 : Beibl. 19, 198 (1932). Type : Däniker 873, New Caledonia, Plateau des Koniambo, 14 Jan. 1925 (holo-, Z, not seen, photocopy at CANB). Because I have only seen a photocopy of the type, I should point out that this is a distinctive, narrowly endemic species, and that I have examined seven collections of it from the type locality.

Boronella was established by BAILLON (1872 : 302) and was based on *B. pancheri* Baill. Subsequently, four additional species were established in the genus, namely, *B. francii* Schltr. (1908 : 26), *B. verticillata* Baill. ex Guillaumin (1911 : 95), *B. parvifolia* E. G. Baker (1921 : 279), and *B. crassifolia* Guillaumin (1932 : 689). As GUILLAUMIN suggested (1911 : 94), *B. francii* appears to be conspecific with *B. pancheri*.

Following is a provisional key to the taxa of *Boronella*. The taxon given as *B. verticillata* s.l., which includes *B. parvifolia*, appears to consist of two or three species, but requires further study. The genus is endemic to New Caledonia.

PROVISIONAL KEY TO THE TAXA

1. Plants glabrous throughout ; flowers in a terminal cyme ; leaves opposite, 3–7 cm long ; petals valvate, carinate, 5–6.5 mm long ; sepals imbricate, 4–4.5 mm long ; carpels 2-ovulate ; follicles about 5 mm long 1. *B. koniambiensis*
- 1'. Plants with indumentum at least in leaf axils and at branchlet apices ; flowers in a simple terminal cluster ; leaves whorled, 0.8–7 cm long ; petals narrowly imbricate, 4–5 mm long ; sepals 1–3 mm long ; carpels 2- or 1-ovulate ; follicles 4–5 mm long.
 2. Sepals imbricate ; flowers with indumentum on disc and base of staminal filaments ; petals scarcely carinate. 2. *B. pancheri*
 - 2'. Sepals valvate ; flowers glabrous throughout ; petals \pm carinate.
 3. Pedicels 1–1.5 mm long. 3. *B. crassifolia*
 - 3'. Pedicels 2–23 mm long. 4. *B. verticillata* s.l.

As is shown above, *Boronella koniambiensis* stands well apart in its lack of indumentum, opposite leaves, cymose inflorescences (BAKER described *B. parvifolia* as having cymes, but in its type collection the flowers are all in simple clusters), and valvate petals. One might consider this to be a generic rather than specific set of differences, but in view of the features the species share, particularly the articulated cortex of their branchlets, which is apparently unique in Malesian-Australasian non-aurantioid *Rutaceae*, I do not believe generic segregation is warranted.

Following is an index to the collections of *Boronella* examined. All are housed at CANB except *Compton* 2296 (BM, holotype of *B. parvifolia*) and *Vieillard* 2448 (W). The numbers in parentheses refer to the corresponding taxon in the key.

Armstrong 1186 (4). *Carolin & Weston* 18102 (1). *Compton* 2296 (4). *Hartley* 15045 (2) ; 15046 (4). *MacKee* 10078 (1) ; 37940, 40296, 41348, 41921, 41926, 41934 (4) ; 42329, 45226 (2) ; 45733, 46057 (4). *McPherson* 1583 (4) ; 2131 (2) ; 2139 (4) ; 2252 (3) ; 2289, 2384 (4) ; 2995 (2) ; 3381, 3961 (4) ; 4992, 5034 (1) ; 5237 (4) ; 5299, 5311 (1) ; 5480 (4) ; 5595 (1) ; 5757, 6416 (4). *Vieillard* 2448 (1). *Veillon* 6361 (4). *Webster & Jaffré* 19264 (1).

Boronella appears to be part of a lineage (i. e., a line of common descent ; a natural group) otherwise comprised of *Myrtopsis* Engl., *Euodia* J. R. & G. Forster (see HARTLEY, 1981 : 92, and HARTLEY & STONE, 1989 : 120), *Brombya* F. Mueller, and *Medicosma* J. D. Hooker (see HARTLEY, 1985). The essential characteristics of this assemblage are as follows : leaves opposite or whorled ; flowers regular, 4- or 5-merous, with 2- or 1-ovulate carpels ; fruit dehiscent, the endocarp discharged elastically with the seed at dehiscence ; seeds exalate ; testa thin and brittle, with inner layer of dense, black sclerenchyma ; endosperm copious ; embryo with \pm flattened, elliptic or suborbicular cotyledons which are considerably wider than the superior hypocotyl. The apparent relationships of these genera are shown in the following outline.

1. Inflorescences terminal or terminal and upper axillary ; leaves simple.
 2. Indumentum, if present, of simple trichomes ; branchlets with cortex articulated at nodes ; flowers 4-merous ; stamens 8, the filament \pm claviform and glandular-papillate distally ; gynoecium 4-carpellate, the carpels connate basally, with a common apical style, the ovules 2 or 1 per carpel ; fruit of 1-4 basally connate follicles ; New Caledonia. 1. *Boronella*
 - 2'. Indumentum of stellate to lepidote trichomes ; branchlets with continuous, non-articulated cortex ; flowers 5- or 4-merous ; stamens 10 or 8, the filament sublinear ; gynoecium 5- or 4-carpellate, the carpels connate basally, with a common style inserted at middle or toward base, the ovules 2 or 1 per carpel ; fruit of 1-5 basally connate follicles or subsyncarpous (carpels united into a 5-locular, loculicidally dehiscent capsule) ; New Caledonia 2. *Myrtopsis*
- 1'. Inflorescences axillary or ramuligerous (i. e., on branchlets below leaves) ; flowers 4-merous ; gynoecium 4-carpellate, the carpels basally connate, with a common apical or subapical style ; fruit of 1-4 basally connate follicles.
 3. Indumentum of simple trichomes ; inflorescences axillary, annual ; ovules 2 per carpel ; chalazal region of seed not enlarged.
 4. Petals valvate ; stamens 8 or 4, the filament sublinear ; follicles with short styler beak ; leaves digitately 3-foliolate or 1-foliolate ; New Guinea and northeastern Australia east to Samoa, Tonga, and Niue. 3. *Euodia*
 - 4'. Petals narrowly imbricate ; stamens 8, the filament dilated and \pm petaloid ; follicles not beaked ; leaves 1-foliolate ; northeastern Australia. 4. *Brombya*
 - 3'. Indumentum of mostly fasciculate, stellate, or sublepidote trichomes ; first-formed inflorescences upper axillary, the basal portion of these usually perennial, becoming \pm woody and producing additional lower axillary and ramuligerous inflorescences ; ovules 2 or 1 per carpel ; chalazal region of seed usually enlarged ; petals narrowly imbricate ; stamens 8 or 4, the filament \pm claviform and glandular-papillate distally or sublinear ; leaves 1-foliolate or rarely digitately 3-foliolate ; southern New Guinea, eastern Australia, and New Caledonia 5. *Medicosma*

From the essential characteristics of the *Boronella* lineage, *Boronia*, like *Correa* Andrews, *Zieria* Smith, and *Neobyrrnesia* J. A. Armstrong, differs in having a linear embryo with \pm plano-convex cotyledons which are the same width as the superior hypocotyl. *Correa* is also distinguishable by its petals, which at least in early anthesis are united for most of their length ; *Zieria* also by its disc, which has prominent antestaminal lobes ; and *Neobyrrnesia* also by its combination of axillary inflorescences and mid-carpellary style-insertion. *Boronia*, except for its embryo, apparently differs consistently from *Boronella* only in having branchlets with continuous, non-articulated cortex ; from *Myrtopsis* only in having apical or subapical insertion of its style ; and from *Brombya* only in having non-petaloid staminal filaments and smaller leaves or leaflets. From *Euodia* and *Medicosma*, it seemingly differs consistently only in its embryo. It is thus important to consider the taxonomic significance of this character.

Among the Malesian-Australasian-Pacific *Rutaceae*, linear embryos appear to be restricted to *Boronia*, *Correa*, *Neobyrrnesia*, *Zieria*, and 13 other mainly shrubby genera, namely, *Asterolasia* F. Mueller (including *Pleurandropsis* Baill. and *Urocarpus* Harvey *fide* WILSON, 1987), *Chorilaena* Endlicher, *Crowea* Smith, *Diplolaena* R. Brown, *Drummondita* Harvey, *Eriostemon* Smith, *Geleznovia* Turcz., *Microcybe* Turcz., *Muiriantha* C. Gardner, *Nematolepis* Turcz., *Phebalium* Vent., *Philotheca* Rudge, and *Rhadinothamnus* Paul G. Wilson. All of these genera occur in Australia (*Eriostemon* and *Zieria* also have one species each in New Caledonia and *Phebalium* also has one species in New Zealand), where they grow mainly in scleromorphic heathland and therein comprise nearly the entire rutaceous component. As shown by SPECHT (1981), this habitat in Australia is characterized by, and apparently driven mainly by, soils that are extremely deficient in plant nutrients. It is probably an

ancient habitat in Australia, dating back to at least the early Tertiary, and throughout its history it probably coexisted with Australian rain forest, which favors more fertile soils.

In my opinion, this assemblage constitutes the whole of the tribe *Boronieae* Bartling and is a natural group defined by the linear embryo. In other features, it shares consistently all of the essential characteristics of the *Boronella* lineage except that the leaves are alternate in all of the genera except *Boronia*, *Correa*, *Neobyrnnesia*, and *Zieria*.

It might be argued, of course, that the linear embryo is merely an ecological specialization and that the *Boronieae* more correctly belongs to a larger lineage including plants with broad cotyledons. I know of no evidence of such specialization, however, and there is evidence that in the *Rutaceae* both broad-cotyledoned and linear embryos are conservative with regard to habitat. For example, *Comptonella* E. G. Baker and *Zieridium* Baill., like *Boronella* and *Myrtopsis*, grow mainly in New Caledonian maquis on serpentine soil, the low nutrient status of which is well documented (see BROOKS, 1987), and have broad cotyledons, as do the southern African endemics *Acmadenia* Bartling & H. L. Wendland, *Adenandra* Willd., *Agathosma* Willd., *Coleonema* Bartling & H. L. Wendland, *Diosma* L., *Euchaetis* Bartling & H. L. Wendland, and *Macrostylis* Bartling & H. L. Wendland, which occur in Australian-like scleromorphic heathland of the Cape Province. Also, *Geijera* Schott, *Melicope* J. R. & G. Forster, and *Sarcomelicope* Engl., like *Euodia* and *Medicosma*, have broad-cotyledoned embryos in both Australian rain forest species and species seemingly restricted to New Caledonian serpentine maquis, while linear embryos are present in both Australian rain forest and scleromorphic heathland plants of *Correa*, *Phebalium*, and *Zieria*.

It is worthwhile noting that the above circumscription of the *Boronieae* differs in several respects from that proposed by ENGLER (1931) in what is the standard major treatment of the tribe. These differences are itemized below.

1. Five genera included in the tribe by ENGLER are herein excluded from it, namely, *Acradenia* Kippist (see HARTLEY, 1977), *Boronella*, *Myrtopsis*, *Rossittia* Ewart & Davies (= *Hibbertia* Andrews *vide* WILLIS, 1942), and *Zieridium*.

2. ENGLER recognized *Pleurandropsis*, which is herein considered to be congeneric with *Asterolasia*.

3. ENGLER placed *Drummondita* in the synonymy of *Asterolasia*; herein (following WILSON, 1971) it is considered to be distinct.

4. Three genera established after ENGLER's time are herein included in the tribe, namely, *Muiriantha*, *Neobyrnnesia*, and *Rhadinothamnus*.

Lastly, it can be added that a chromosome count of $n = 12$ has been reported, without mention of a voucher, for an unidentified species of *Boronella* (SMITH-WHITE, 1959). As far as I can determine, this count has not been obtained from any species of *Boronia*, so if the report is correct, it may add another character to the differences between the two genera. Unfortunately, there seem to be no published chromosome counts for other taxa of the *Boronella-Medicosma* lineage (there are several for *Euodia* as it was traditionally construed, but they are all based on species that are now considered to be more correctly placed in either *Melicope* or *Tetradium* Lour.).

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